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ISOLINES

Objective: To practice interpreting and drawing isolines.

Reference: McKnight and Hess, *Physical Geography*, 8th ed., pp. 41–43.

ISOLINES

Often in geography we are interested in mapping particular characteristics of an area, such as the elevation, the amount of rainfall, or the temperature. A common and very useful method of showing varying levels or concentrations of some phenomenon is with **isolines**. An isoline is a line on a map that connects points of equal value.

For example, **contour lines** on topographic maps are isolines that show elevation. In our study of weather and climate we will use several kinds of isolines, such as **isotherms**, to show temperature, and **isobars** to show atmospheric pressure.

There are just a few basic rules pertaining to all isolines:

(a) An isoline connects points on a map where the value of some phenomenon is the same.

(b) Isolines are drawn at regular intervals (for example, for every 5° of temperature difference).

(c) Isolines are always closed lines, although they often close beyond the margins of a map.

(d) Isolines never cross each other.

(e) Where isolines are close together, they show a rapid horizontal change in the phenomenon; where they are far apart, they show a gradual horizontal change.

(f) Values inside a closed isoline are either higher or lower than those outside the closed isoline (it is usually clear which is the case based on the pattern of adjacent isolines).

The following example will help illustrate how isotherms are drawn. Figure 1 shows a simple map with temperatures plotted for 17 different cities.

We will draw isotherms at 5° intervals (15°, 20°, 25°, etc.). An isotherm will pass through any point with the same value as the isotherm, but between higher and lower values. On one side of the line, the temperatures will be higher than the value of the isotherm, while on the other side, temperatures will be lower.

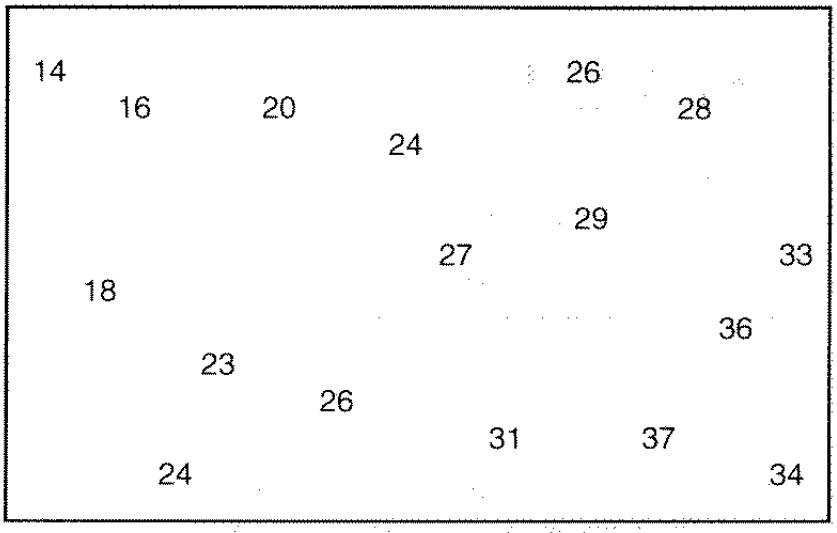


Figure 1: Map showing the temperatures in 17 cities.

Drawing isolines involves interpolation. For example, the 15° isotherm passes between the 14° and 16° locations, while the 27° location is about half way between the 25° and 30° isotherms. Figure 2 shows the completed isotherm map. Notice that isotherms show the spatial pattern of temperature more clearly than the temperatures of the cities alone.

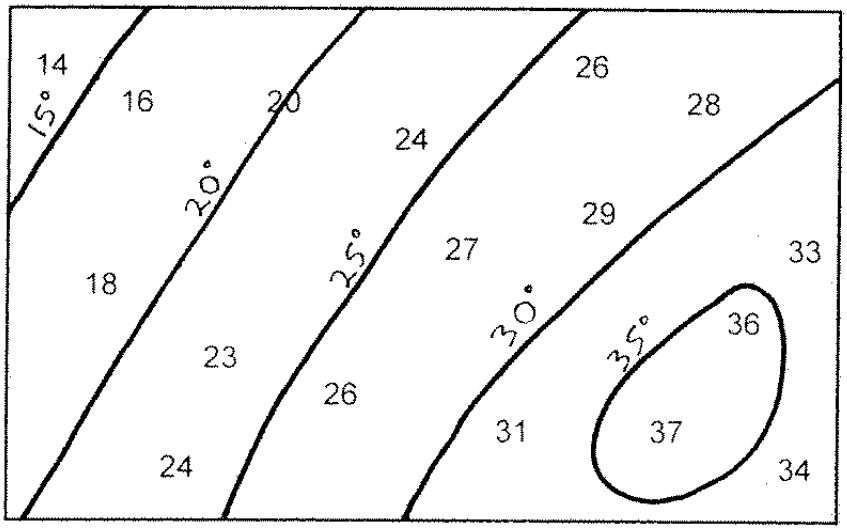


Figure 2: Temperature map with isotherms drawn.

Name _____ Section _____

PROBLEMS—PART I

The following questions are based on the isotherm map below, showing average January sea-level temperatures in °C and °F. Eight lettered points (labeled "A" to "H") are shown on the map.

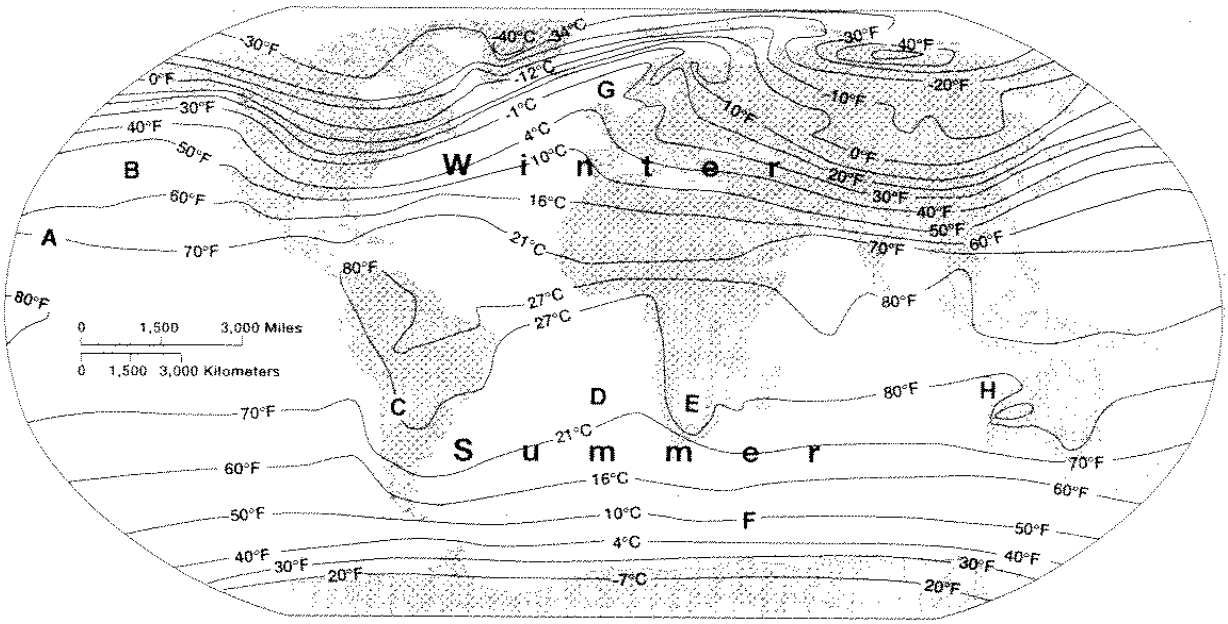


Figure 3: Average January sea-level temperatures (°C and °F). (Adapted from McKnight and Hess, *Physical Geography*, 7th ed.)

Determine the average January sea-level temperature at the following eight lettered points. Indicate if your answers are in °C or °F:

°C or °F (circle scale used)

A _____ E _____

B _____ F _____

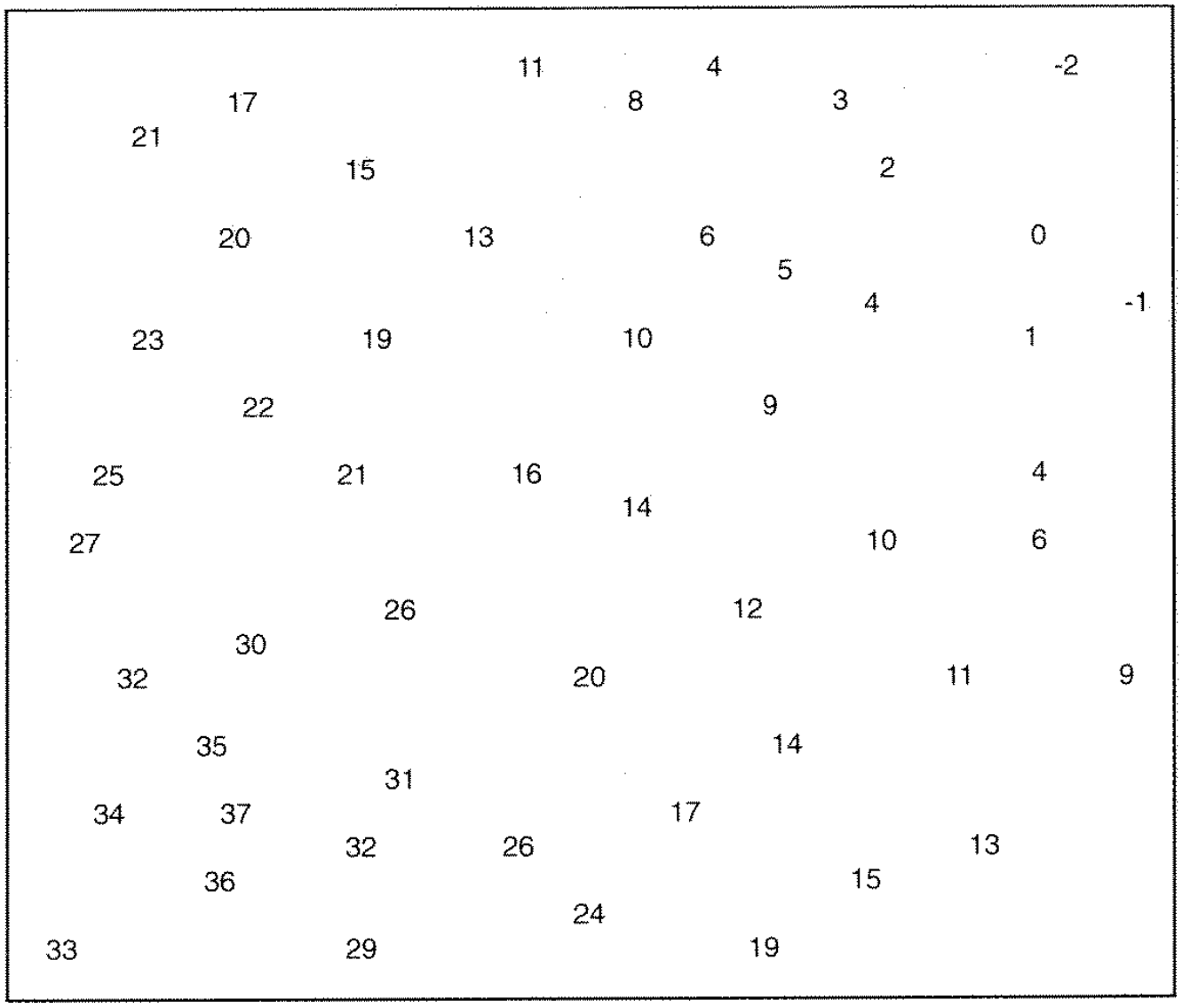
C _____ G _____

D _____ H _____

Name _____ Section _____

PROBLEMS—PART II

The map below shows the location of 52 cities. The temperature of each city is given in degrees. Draw isotherms at 5° intervals, beginning with the 0° isotherm in the upper right corner. Label each isotherm.



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CONTOUR LINES

Objective: To learn to interpret elevation contour lines.

Reference: McKnight and Hess, *Physical Geography*, 8th ed., pp. 41–43 and p. A3.

CONTOUR LINES

In previous exercises, we used isolines to illustrate the distribution of various phenomena. We used isotherms to show patterns of temperature, and isobars to show patterns of pressure. In the study of landforms, we often use maps showing elevation with isolines known as **contour lines**.

Contour lines are lines that connect points of equal elevation. Contour lines enable us to study the topography of a region from a two-dimensional map. Figure 1 shows a simple contour line map and a profile cross section through the landscape.

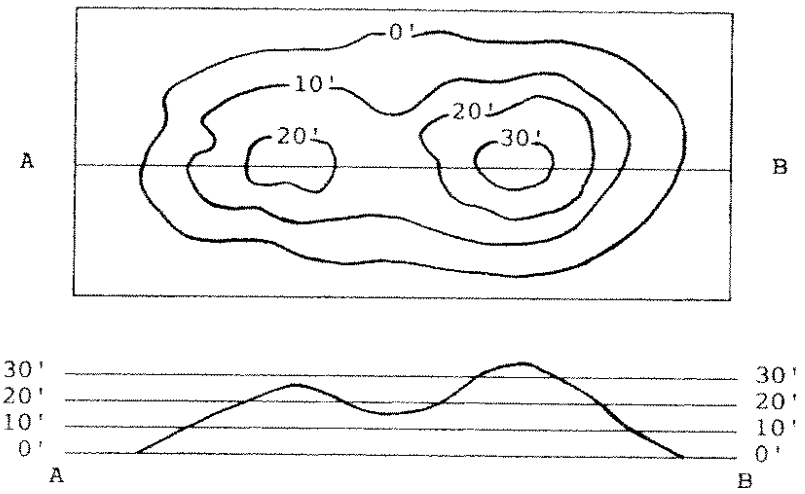


Figure 22-1: Simple contour line map and profile.

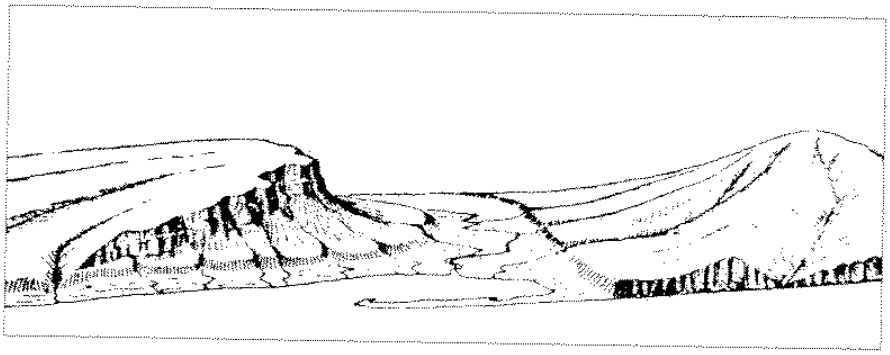
SAMPLE CONTOUR LINE MAP

Figure 2 shows a fictitious landscape and a contour line map of the same landscape with various elevations and features labeled.

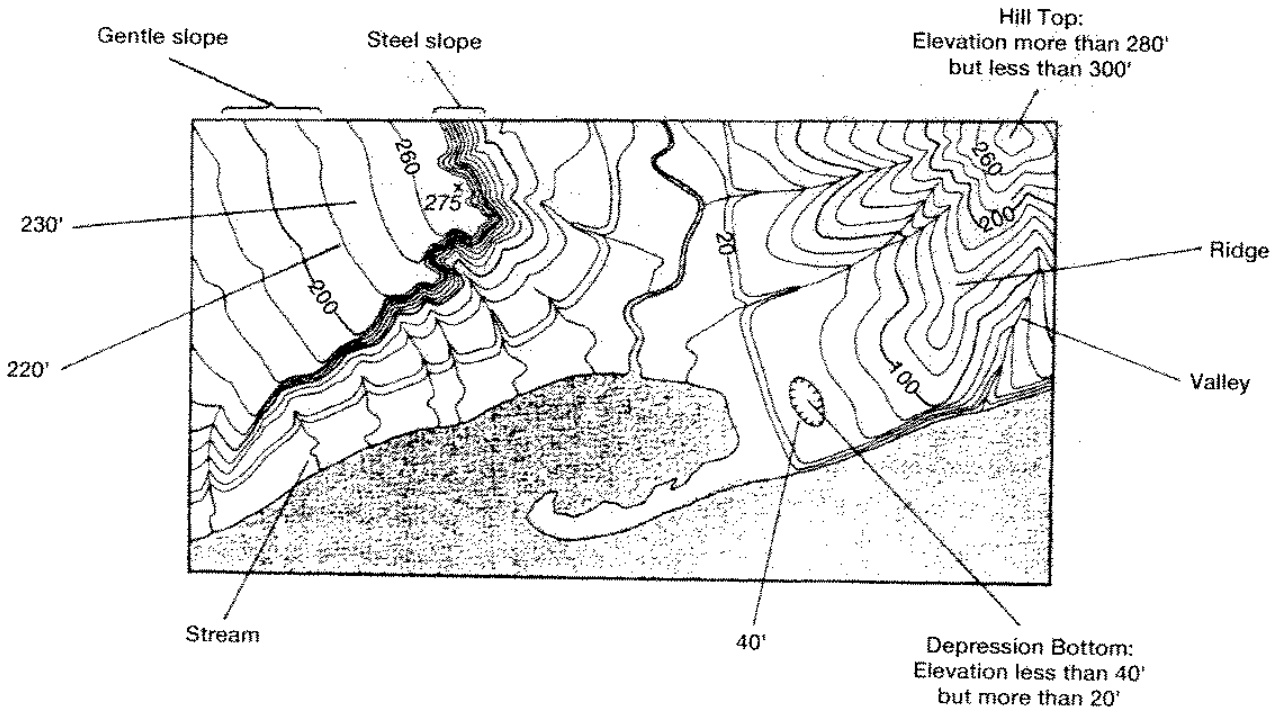
CONTOUR LINE RULES

The following rules will help you interpret contour lines:

1. A contour line connects points of equal elevation.
2. The difference in elevation between two contour lines is known as the **contour interval**.
3. Usually every fifth contour line is a darker **index contour**. (On some maps, every fourth line is an index contour.)
4. Elevations on one side of a contour line are higher than on the other side.
5. Contour lines never cross one another, although they may touch at a vertical cliff.
6. Contour lines have no beginning or end. Every line closes on itself, either on or off the map.
7. Uniformly spaced contours indicate a uniform slope.
8. If spaced far apart, contour lines indicate a gentle slope. If spaced close together, they represent a steep slope.
9. When crossing a valley, gully, or "draw," a contour line makes a "V" pointing uphill.
10. When crossing a spur or a ridge running down the side of a hill, a contour line makes a "V" pointing downhill.
11. A contour line that closes within the limits of the map represents a hill or rise. The land within the closed contour is higher than the land outside the closed contour.
12. The top of a hill shown with closed contour lines is higher than the uppermost closed contour, but lower than the next highest contour that hasn't been shown on the map.
13. A small depression is represented by a closed contour line that is hachured on the side leading into the depression. Hachured contours are called **depression contours**.



(a)



(b)

Figure 2: (a) Fictitious landscape; (b) Sample contour line map (contour interval 20'; adapted from U.S. Geological Survey).

(a) Map View:

(b) Profile View:

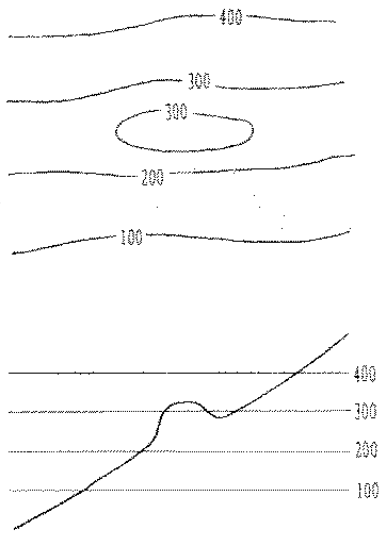


Figure 3: Map view and profile view of a closed contour line on a slope.

14. A closed contour line between two other contours (such as would show a bump on the side of a hill) is the same elevation as the adjacent upslope contour line (Figure 3).

15. Unless otherwise marked, the elevation of a depression contour is the same as that of the adjacent lower regular contour (Figure 4).

Unless otherwise noted in a Lab Manual exercise or by your instructor, estimate elevations between contour lines to the nearest half-contour interval, and estimate the elevation of the top of a hill to be one-half-contour interval higher than the highest contour line shown.

(a) Map View:

(b) Profile View:

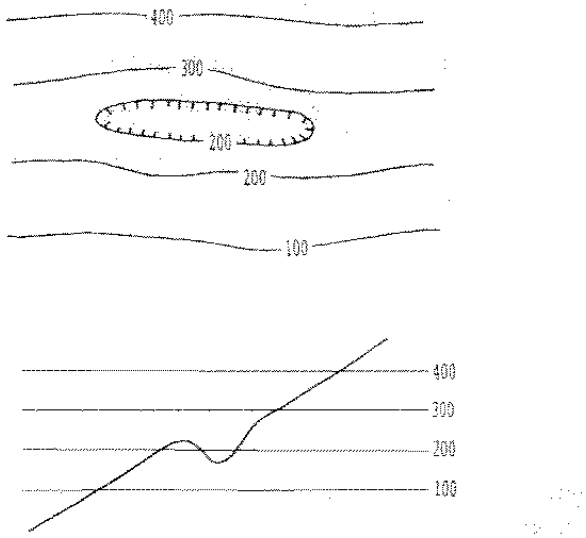


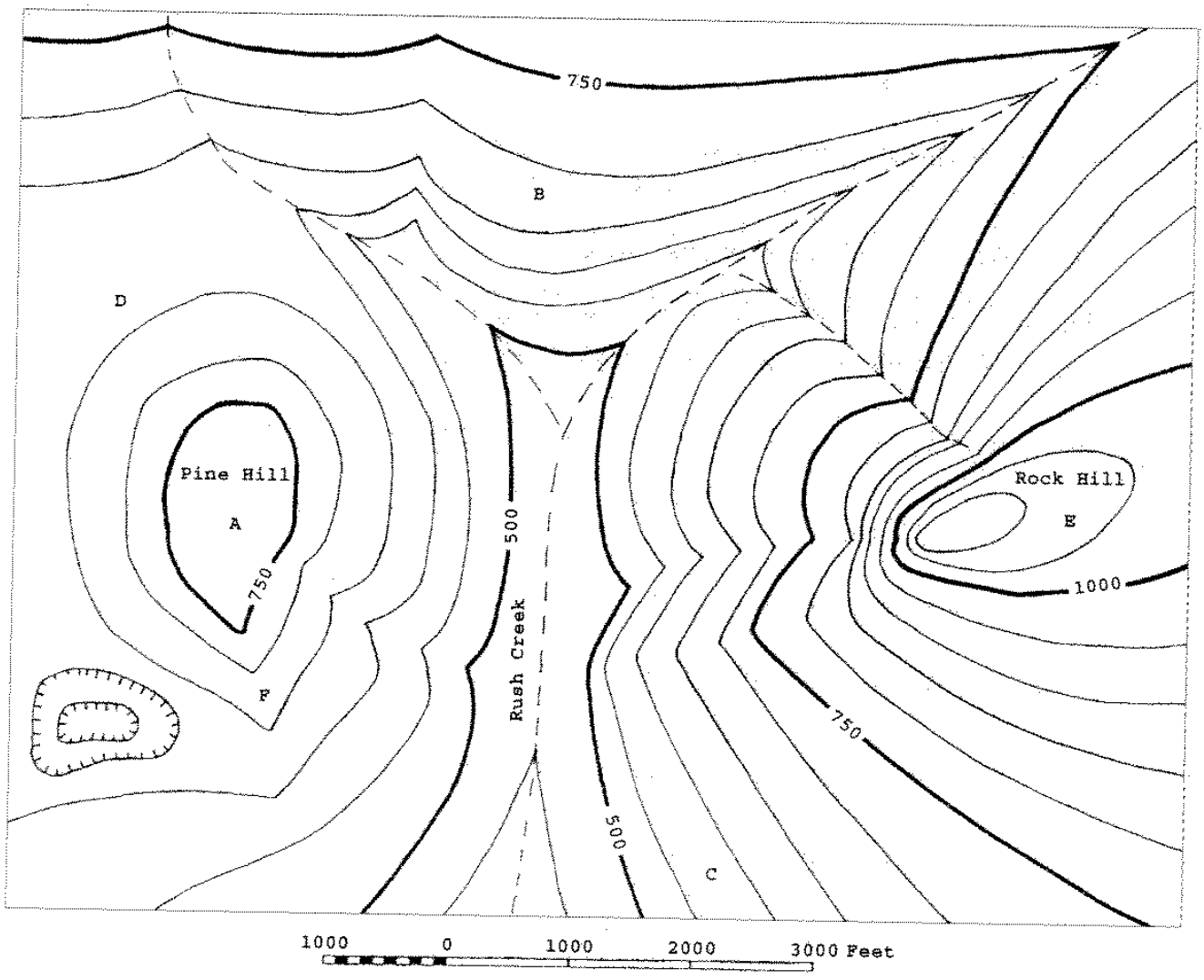
Figure 4: Map view and profile view of depression contour line on a slope.

Name _____ Section _____

PROBLEMS

The questions in this exercise are based on this contour line map with elevations shown in feet.

- North is to the top of the map.
- Streams are shown with dashed lines.
- A graphic scale for measuring horizontal distances is shown below the map.
- Estimate elevations between contour lines to the nearest half-contour interval; assume that the top of a hill is one-half-contour interval higher than the highest contour line shown.



Contour Lines

1. What is the contour interval? _____ feet

2. What is the elevation of Point A? _____ feet

3. What is the elevation of Point B? _____ feet

4. What is the elevation of Point C? _____ feet

5. Which lettered point has the highest elevation? _____

6. Which lettered point has the lowest elevation? _____

7. (a) Where is the highest elevation shown in this landscape? (It may not be a location marked with a letter.) _____

   (b) What is the elevation of this highest location? _____ feet

8. (a) Where is the lowest elevation shown in this landscape? (It may not be a location marked with a letter.) _____

   (b) What is the elevation of this lowest location? _____ feet

9. What is the "local relief" of this landscape (the difference in elevation between the highest and lowest locations)? _____ feet

10. Which lettered point is most clearly on a spur or ridge running down the side of a hill? _____

11. Is it possible to see D from F? _____

12. Is it possible to see D from B? _____

13. What is the elevation at the bottom of the depression southwest of Pine Hill? _____ feet

14. How deep is the depression (from the lip of the depression to its bottom)? _____ feet

15. What is the horizontal distance from C to B? _____ feet

16. In which direction does Rush Creek flow? From _____ to _____

17. Draw a 1 centimeter ($\frac{1}{2}$") diameter circle around the location of the steepest slope shown on the map.

18. Draw in three more streams as indicated by the contour pattern (but not shown on the map with dashed lines).

Contour Lines – San Bernardino North Quadrangle

For this section of the lab, it is very important that you read along and not just answer the questions!!!

A contour line is a line on a map which joins together points which have the same elevation. Elevation of the land surface is measured in feet or meters above a datum, such as sea level. On USGS topographic (topo) maps, the datum is mean sea level, so all elevations are in feet above sea level. Contour interval is the change in elevation moving from one contour line to the next. The contour interval of a map can be set at any convenient elevation spacing – 1, 10, 20, 50, 100, or 1000 feet. In general, a large contour interval is used when the terrain is steep and rugged, and a small contour interval is used when the terrain is relatively flat.

1) What is the contour interval on the San Bernardino North map? _____

Look at all the different contour lines on the map. Note that every fifth line is a heavier brown line, called an index contour line. On this map, the index contour lines are at, for example, 1200 ft., 1400 ft., 1600 ft., etc., above sea level. Intermediate contours are usually not labeled, so you must determine their elevation by counting up or down from the nearest labeled contour line. In flatter areas, such as flood plains of rivers, supplementary contour lines are often added for every five or ten feet of change in elevation, as specified on the map legend. These supplementary contours are shown by thin dashed brown lines and can be seen on this map in the Lytle Creek Wash at the Southwest corner of the map.

2) What is the elevation at the Water Tank immediately to the right of Rialto Spring (North)? _____

3) What is the elevation of the small lake just south of the word Creek in Lytle Creek Wash? _____

There are a few general rules regarding contour lines which will help you to understand the shape of the land surface.

Do not cross

Contour lines do not cross each other and they do not branch off.

Continuous

Each contour line is continuous and closes on itself unless interrupted by the edge of the map.

Find Arrowhead Peak, notice how the contour lines close in on themselves creating a ring of circles. This indicates a peak.

4) Find the 1400 foot contour line at the Southwest corner of the map. Does it close in on itself or is it interrupted by the edge of the map?

_____

In the case of depressions, such as sink holes or pits, contours enclose lower ground. In these cases, a special symbol is used – a contour line with short spikes or tick marks which point into the depression. The spikes on the contour line indicates that the land within each enclosed contour is below the elevation marked by the contour line. Though rare in general (unless of course you are in a karst region), there are some located in Lytle Creek Wash and two located due north of Parkside School.

5) What is the approximate elevation at the bottom of the larger pit found in the Lytle Creek Wash?

_____

6) What is the approximate elevation at the bottom of the long pit found just north Parkside School?

_____

Steepness

Spacing of contour lines indicates the relative steepness of the land surface. Closely spaced contour lines indicate a steep slope; widely spaced contour lines indicate a gentle or flat slope.

Go back to Arrowhead Peak and look at the contour lines on either side of this mountain.

7) Which side of the slope is steeper, the north side or the south side? _____

The direction in which a slope faces is called the aspect of the slope. Aspect is a very important factor in local soils, vegetation and geomorphology. In the Northern Hemisphere, south-facing slopes receive more intense sunlight than north-facing slopes because the south-facing slope is oriented toward the incoming rays of sunlight.

Therefore, south-facing slopes are in sunlight most of the day, and north-facing slopes may be in shadow most of the day. Soils are generally warmer and drier on the south-facing and west-facing slopes than on north-facing slopes. As a result, the vegetation cover may be grassland on south-facing slopes and forest on north-facing slopes.

Contour lines indicate the direction of flow of rivers and streams. Contour lines are V-shaped where they cross streams. The point of the V points in the upstream direction (upslope).

8) Locate East Twin Creek on the Northeast section of the map (close to the edge). In what compass direction is this creek flowing?

_____

9) What is the name of the USGS Quad map to the immediate West of the San Bernardino North Quad?

_____

10) What is the name of the USGS Quad map to the immediate Southeast of the SBN Quad?

_____

11) Estimate the latitude (to the nearest half-minute [30"]) of Mountain View Cemetery?

_____